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PATENT SPECIFICATION (11) 1 491 291

(21) Application No. 22339/75 (22) Filed 22 May 1975 (19)
(31) Convention Application No. 2 446 515
(32) Filed 28 Sept. 1974 in
(33) Fed. Rep. of Germany (DT)
(44) Complete Specification published 9 Nov. 1977
(51) INT. CL.² B60N 1/02
(52) Index at acceptance
A4U 6

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(54) SPRING MOUNTING FOR A SEAT

(71) I, GEORG WILLIBALD GRAMMER, a citizen of the Federal Republic of Germany, trading as FIRMA WILLIBALD GRAMMER, of Ziegelgasse 12, D-8450 Amberg, The Federal Republic of Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a spring-biased mounting for a seat, said mounting being of the kind having a seat frame and a floor frame interconnected by two pairs of arms, each arm or each pair of arms being pivotally connected at one end to one of the frames and being slidably guided on the other frame at the other end whereby the seat frame is guided to change its height relative to the floor frame without substantial change of orientation.

In seats, in particular driver's seats, having a spring-biased mounting of the kind referred to, it is very frequently required that the overall height of the understructure should be kept as small as possible in order to offer the possibility of providing the seat with sufficiently thick padding, but nevertheless not obtaining too great a seat height. It must also be taken into consideration at the same time with driver's seats that in such a case an adequate spring elongation (normally at least 80 mm) must be available. Moreover, it should also be mentioned that spring-biased mountings of the kind referred to, when used for supporting driver's seats are frequently mounted on rails which permit longitudinal shifting of the seat towards the control elements of the vehicle.

In the known spring-biased mountings of the kind referred to, the procedure has generally been to employ torsion rods for springing purposes, these torsion rods being attached centrally to the floor frame or supporting frame and their ends being engaged by the ends of two corresponding arms of the two pairs of arms which are located respectively on the two opposite ends of the spring-biased mounting. In this way, an adequate spring deflection can be obtained with a small overall height of the spring-biased mounting and, in addition, it is possible also to provide for a suitable height adjustment of the seat. The fitting of torsion rods as spring elements, however, has a number of disadvantages. Firstly, it is difficult to obtain torsion rods with a suitable characteristic at justifiable cost. Secondly, in particular the adjustment of the springing properties, which is taken absolutely for granted in a high-quality drivers' seat mounting and for which in fact the torsion rod must be twisted in the region of its point of attachment to one of the frames, creates difficulties.

Driver's seats with spring-biased mountings of the kind referred to are also already known in which not a torsion rod, but a tension or compression spring, is employed. In these known seats, however, a relatively costly mechanism serves basically to transmit the movement of the scissors to the springs. Moreover, it is not ensured that the seat will meet all requirements, in particular as regards the possibility of adjusting the spring force.

The object of this invention is to provide improvements in spring-biased mountings of the kind referred to for seats, in particular a vehicle seats, whereby it is made possible to keep the overall height of such spring-biased mountings as low as possible at a small cost of construction.

With this object in view, there is provided according to this invention a spring-biased mounting for a seat, said mounting having a seat frame and a floor frame interconnected by two pairs of arms, each arm being pivotally connected at one end to one of the frames and being slidably guided on the other frame at the other end whereby the seat frame is guided to change its height relative to the floor frame without substantial change of orientation, a travelling support biased by spring means and movable along one of the frames and a supporting lever swingable with two corresponding arms of

the two pairs of arms and having at its free end a run-up cam surface engageable with the travelling support whereby upon downward loading of the seat the swing of the supporting lever imparts a linear movement to the travelling support against the bias exerted by the spring means and the load is transmitted through the supporting lever and the travelling support to the spring means.

This principle of construction of the springing device firstly brings the advantage that a comparatively large spring elongation can be achieved even with a small overall height. Furthermore, construction is very simple. Indeed, to transmit the force from the spring to the two pairs of arms, substantially only the travelling support connected in some way to the spring, and which must naturally be guided to some extent, and the supporting lever moved together with the said two corresponding arms of the two pairs of arms are necessary. Another advantage of the springing device according to the invention is moreover the run-up cam surface may, of course, be variously shaped so as to obtain in this way a very definite spring characteristic, for example so as to cause a comparatively small spring force to act in the first section of the path of movement, this spring force increasing progressively when the spring-biased mounting yields to a great extent. No particularly costly means are necessary for this variation in the spring characteristic, however.

The spring-biased mounting according to the invention can easily be constructed and arranged so as to enable the height of the supporting frame and seat part above the floor or base frame to be adjusted, by coupling the supporting lever to the above-mentioned two corresponding scissors arms by way of a connecting element which allows the position of the supporting lever relative to these arms to be adjusted.

A preferred embodiment of the invention will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:—

Figure 1 is a plan view of the understructure of a vehicle seat with a springing device and height adjustment;

Figure 2 is a side view of the vehicle seat understructure according to Figure 1;

Figure 3 is likewise a side view of the understructure in a position which is changed with respect to Figure 2, and

Figure 4 shows a detail of Figures 2 and 3 on a larger scale and in a position which is once again changed.

The understructure of the seat shown in the drawings has a floor frame 1, which is intended to be fixed to a vehicle chassis and a supporting frame 2 (shown in chain-dotted lines in Figure 1), the seat part proper 3 being secured to the supporting frame 2. The floor frame 1 and the supporting frame 2 are interconnected by two scissors each formed by two arms 5, 6 and 5^1, 6^1, pivotally connected to each other by means of a connecting bolt 4. Those ends of the inner scissors arms 5, 5^1 which are on the left in the drawings are each pivotally connected to the floor frame 1 at a bearing point 7. The corresponding ends of the outer scissors arms 6, 6^1 are pivotally connected to the supporting frame 2 at bearing points 8. The other ends of the scissors arms 5, 5^1 and 6, 6^1 are provided with rollers 9 which are movable respectively in guides 10 on the floor frame 1 and guides 11 on the supporting frame 2 parallel to the main plane thereof, so as to enable the angle between the scissors arms 5, 5^1 and 6, 6^1 to be adjusted for substantially parallel raising and lowering of the supporting frame 2 with respect to the floor frame 1. Since this construction of the scissors-type understructure comprising the scissors arms 5, 5^1, 6, 6^1, the bearings 7, 8, the rollers 9 and the guides 10, 11 is generally known *per se*, a detailed description of the position of the individual parts, etc. will be refrained from here.

Figure 1 in particular shows clearly that the ends 12 of the scissors arms 5, 5^1 which ahe pivotally connected to the floor frame 1 at the bearing points 7 are rigidly connected to each other by means of a shaft 13 formed by a tube, the ends of which are fixed, e.g. welded at 14 to the ends 12 of the two scissors arms 5 and 5^1 respectively. In this way, the two scissors formed by the arms 5, 6 and 5^1, 6^1 are constrained to move together through equal angles.

In order to damp shocks occurring when travelling through potholes or the like, a shock absorber 15 is inserted between the floor frame 1 and the supporting frame 2, one end 16 of this shock absorber being pivotally connected to the floor frame 1, while the other end 17 thereof is pivotally connected to the supporting frame 2.

In the embodiment shown, two tension springs 18 arranged parallel to one another in the area of the floor frame 1 serve for mutually springing the floor frame 1 and the supporting frame 2, the tension springs being attached at one end to studs 19 or the like on the floor frame 1 (see Figure 1). The other ends of the tension springs 18 engage at 38 the opposite ends of a bearing block 20 which is supported by means of a nut 21 on a screw-threaded spindle 22 so that, on rotation of the screw-threaded spindle 22 by means of a handle 23, it moves axially along the spindle 22 as shown by the arrow 24 in dependence upon the direction of rotation of the handle 23. In this way, the initial tension of the tension springs 18 can be varied for adaptation to different loads on

the seat part 3. In order to support the tension of the tension spring 18, a collar 25 on the handle 23 is supported against an edge flange 26 of the floor frame 1, while the screw-threaded spindle 22 extends through a corressponding hole in the edge flange 26.

At its end remote from the handle 23, the screw-threaded spindle 22 carries a fork 28 which can swivel about the longitudinal axis 27 of the spindle 22. Arranged close to the extremities of the tines of the fork 28 is a spindle 29 on which are rotatably mounted a supporting roller 30 and, on both sides of this supporting roller, two guide rollers 31 of larger diameter than the supporting roller 30. The supporting roller 30 and the guide rollers 31 are likewise freely rotatable relative to one another. The guide rollers 31 run on the base 32 of the floor frame 1, while the supporting roller 30 is held at a certain distance from the base 32 in consequence of its smaller diameter and can therefore rotate freely.

It is therefore apparent from the drawings in conjunction with the foregoing description that the supporting roller 30 is urged towards the shaft 13, i.e. to the left in the drawings, by the tension springs 18 via the fork 28, the screw-threaded spindle 22 and the bearing block 20.

A run-up cam surface 33 at the free end of a supporting lever 34 acts on the supporting roller 30 (Figs. 2 to 4).

In the preferred embodiment illustrated in the drawings, the supporting lever 34 is rotatably mounted on the shaft 13 in order to enable it to be disengageably locked, by means which will be described later, in any selected one of several different angular positions with respect to transmission levers 39 which are welded to the shaft 13 for the purpose of adjusting the height of the seat part above the floor frame 1.

To facilitate explanation of the mode of operation of the springing system of the seat, it is convenient, however, at this stage to consider a simplified variant of the embodiment illustrated in which the supporting lever 34 is rigidly connected to the shaft 13 and the height of the seat part 3 above the floor is not adjustable. With this variant, the supporting roller 30, which is forced to the left in the drawings by the springs 18, acts on the run-up cam surface 33 of the supporting lever 34, which is thereby forced upwardly into the position shown in solid lines in Figure 2 and in Figures 3 and 4. When the supporting lever 34 is rigidly connected to the shaft 13, the scissors arms 5, 5^1 will also of course move in the same direction under the action of the tension springs 18 and the supporting frame 2 will adopt its upper end position.

If a load now acts on the seat part 3 in the direction of the arrow 35 (Fig. 2), this will cause the supporting lever 34 to swing downwardly in the direction of the arrow 36, towards the bottom end position of this supporting lever 34 which is shown in chain-dotted lines in Figure 2. During this downward movement of the supporting lever 34 in the direction of the arrow 36, the fork 28 is shifted to the right in the drawings (arrow 37) by the co-operation of the run-up cam surface 33 with the supporting roller 30. This shifting movement of the fork 28 is transmitted via the screw-threaded spindle 22 to the bearing block 20, as a result of which the points of attachment 38 of the tension springs 18 are likewise shifted correspondingly and the tension springs 18 are stretched to take the load in the direction of the arrow 35. This right-hand end position of the supporting roller 30 is shown in chain-dotted lines in Fig. 2.

It can easily been seen that, with such a springing arrangement, the spring characteristic can be varied to adapt to different operating conditions by varying the shape of the run-up cam surface 33 at the free end of the supporting lever 34. Furthermore, when springing of this kind is employed, the understructure of the seat can of course be constructed to be very low, since the springs 18 which generally require a large amount of room can be arranged parallel to the floor frame 1.

Since, during the springing action, the screw-threaded spindle 22 moves axially to and fro, the handle 23 will likewise move correspondingly, i.e. it will project to a gerater or lesser extent beyond the edge flange 26 of the floor frame 1, its movement taking place in synchronism with the oscillation of the seat part 3. This circumstance is not disturbing, however, since the seat part 3 normally projects still further beyond the edge flange 26 of the floor plate 1, as shown in Figure 2.

In the embodiment illustrated in the drawings, however, the supporting lever 34, instead of being rigidly connected to the shaft 13, as in the variant just described, is mounted so as to be loosely rotatable on the shaft 13 and the pivotal movement of the scissors arms 5, 5^1 about the axis of the shaft 13 is transmitted to the supporting lever 34 by two transmission levers 39 arranged one on each side of the supporting lever 34 and welded to the shaft 13 as 40 (see in particular Figure 4). Each of these transmission levers 39 is provided at its free end with a toothed segment 41, the design of the teeth of which is clear from Figure 4.

A detent 42, which is of substantially bar-like form and extends through an opening 43 in the supporting lever 34, co-operates with the toothed segments 41. The detent 42 is urged towards the toothed segments 41 by tension springs 44 attached to its two ends

and arranged on the outside of the transmission levers 39. Pins 45 are provided on the transmission levers 39 for securing the ends of the tension springs 44 remote from the detent 42.

With the aid of the locking device formed by the detent 42 and the toothed segments 41 of the transmission levers 39, it is possible to lock the supporting lever 34 in different angular positions with respect to the transmission levers 39 and the scissors arms 5, 5^1, as can be seen by comparison of Figures 2 and 3. If the detent 42 is engaged in the uppermost notches of the toothed segments 41 (Figure 2), the scissors arm 5, 5^1 assume a comparatively small angle with respect to the base 32 of the floor plate 1 in the unloaded state of the seat. If, on the other hand, the detent 42 is engaged in notches of the toothed segments 41 located lower down (whereby a position similar to that of Figure 3 results), a larger angle is obtained between the scissors arms 5, 5^1 and the base plate 32 of the floor plate 1 in the unloaded state. Consequently, the supporting frame 2 is at a greater distance from the floor frame 1. Thus, by engaging the detent 42 with different notches of the toothed segments 41, it is possible to adjust the height of the seat part 3 with respect to the floor plate 1. On loading of the seat part 3 in the direction of the arrow 35, the supporting lever 34 moves in the manner described, irrespective of the particular angular position between the supporting lever 34 and the transmission levers 39, and in so doing shifts the supporting roller 30 (to the right in the drawings) thereby tensioning of the springs 18.

As shown in Figures 2 to 4, the edge of the detent 42 which comes into engagement with the toothed segment 41 is chamfered on its underside at 46. Similarly, the upper flanks 47 (Figure 4) of the individual teeth of the toothed segments 41 of the transmission levers 39 are also chamfered so that, on the seat part 3 being raised, whereby the scissors arms 5, 5^1 and consequently also the transmission levers 39 are swung in the direction of the arrow 48, the detent 42 will be automatically disengaged from the teeth of the toothed segments 41. As soon as the seat part 3 is released, on the other hand, the top 49 of the detent is applied against the lower flanks of the individual teeth of the toothed segments, the detent 42 being pulled into the position of engagement by the springs 44. In this way, it is therefore possible, by merely raising the seat part 3, to lock the seat in stages at different distances above the floor frame 1.

In the seat understructure illustrated, the possibility of lowering the seat part 3 is provided by two disengaging plates 50 which are associated respectively with the two transmission levers 39 and which, in consequence of their special form, ensure that, on the seat part 3 being raised beyond the uppermost locking position (Figure 3), the detent 42 is held in a position in which it cannot engage the teeth of the toothed segments 41. The detent 42 then remains in this position until the seat part 3 has been lowered, together with the supporting frame 2, to such an extent that the detent 42 can engage the uppermost notches 51 of the toothed segments 41.

Each of the disengaging plates 50, the configuration of which is shown in Figure 4, has a slot 52 in its edge directed towards the shaft 13, the slot having resting therein a pin 53 connected to the supporting lever 34 (Figure 1). Moreover, each disengaging plate 50 has an opening 54 into which projects a stud 55 on the associated transmission lever 39. Finally, the front edge 56 of each disengaging plate 50 is inclined in the manner visible shown in Figures 2, 3 and 4 and angled at its lower end to form an abutment surface 57 for the detent 42.

The disengaging plates 50 operate in the following manner: As long as the detent 42 is opposite one of the notches of the toothed segments 41 of the transmission levers 39, the disengaging plates 50 do not act on the detent 42. They then occupy the position shown in Figure 2, in which the studs 55 are a short distance beneath the top edges of the openings 54.

If the supporting frame 2 is now raised to such an extent that the lower ends of the toothed segments 41 assume positions above the detent 42, the studs 55, after moving up into engagement with the top edges of the openings 54 in the disengaging plates 50, will have swung these plates upwardly about the pins 53. During the upward swinging movement of these plates 50, the inclined front edges 56 thereof will have interacted with the chambered underside 46 of the detent 42 so as to force the detent back against the action of the springs 44 until the main end surface of the detent engages the abutment surfaces 57 of the disengaging plates 50 as shown in Figure 3.

If the supporting frame 2 is now lowered again, the detent 42 continues to be held against the abutment surfaces 57 of the disengaging plates 50 by the springs 44. The result of this is that the disengaging plates 50 remain in fixed positions with respect to the supporting lever 34 and thus do not move because the supporting lever 34 is also held in the upper end position shown in Figure 3 by the supporting roller 30 and by an abutment 58 on its pivoted end which prevents it from swinging upwardly.

During the movement of the transmission levers 39, the studs 55 carried by these levers move downwardly in the openings 54 away from their top edges until they reach the

position shown in Figure 4. The studs 55 then act on the bottom edges of the openings 54 and thereby move the disengaging plates 50 downwardly. As a result of this movement, the abutment surfaces 57 of the disengaging plats 50 come out of engagement with the front edge of the detent 42. The detent 42 can thereupon engage in the top notches 51 of the toothed segments 41. Such engagement occurs immediately after the parts have reached the positions shown in Figure 4. The seat is then locked in the lower end position without any special manipulation having been required.

If the driver wishes to bring the seat into a somewhat higher position, he merely raises the seat part 3 until a renewed locking action takes place between the detent 42 and further notches of the toothed segments 41.

Thus, in the seat shown, adjustment of the height of the seat part 3 is effected in simple manner by the driver merely raising the seat to the required level, whereupon locking will occur at that level. If, on the other hand, the driver wishes to lower the seat, he must raise it beyond the uppermost locking position, then lower it completely—with the detent held out of engagement—and then raise it again to the desired position. Thus, the height adjustment can be effected extremely rapidly without employing any special manipulation.

The vehicle seat described above with reference to the accompanying drawings includes features which are claimed in the specification of my copending Patent Application No. 22340/75 (Serial No. 1,491,292).

WHAT I CLAIM IS:—

1. A spring-biased mounting for a seat, said mounting having a seat frame and a floor frame interconnected by two pairs of arms, each arm or each pair of arms being pivotally connected at one end to one of the frames and being slidably guided on the other frame at the other end whereby the seat frame is guided to change its height relative to the floor frame without substantial change of orientation, a travelling support biased by spring means and movable along one of the frames and a supporting lever swingable with two corresponding arms of the two pairs of arms and having at its free end a run-up cam surface engageable with the travelling support whereby upon downward loading of the seat the swing of the supporting lever imparts a linear movement to the travelling support against the bias exerted by the spring means and the load is transmitted through the supporting lever and the travelling support to the spring means.

2. A seat mounting as claimed in claim 1, in which the said two corresponding arms with which the supporting lever is swingable are rigidly interconnected.

3. A seat mounting as claimed in claim 1 or 2, in which the supporting lever is arranged substantially parallel to the said two corresponding arms.

4. A seat mounting as claimed in any of claims 1 to 3, in which the supporting lever is coupled to the said two corresponding arms by way of a connecting element which allows the position of the supporting lever relative to these arms to be adjusted.

5. A seat mounting as claimed in claim 1, in which the said two corresponding arms are pivotally connected to the floor frame and are swingable together with the supporting lever about the axis of this pivotal connection.

6. A seat mounting as claimed in any of the preceding claims, in which means are provided for adjusting the tension of the spring means by which the travelling support is biased.

7. A seat mounting as claimed in claim 6, in which the spring means is connected between the frame along which the travelling support is movable and a bearing block and the means for adjusting the tension thereof includes a screw-threaded spindle extending in the direction of travel of the travelling support and screw-coupled to the bearing block, the said spindle being mounted in the frame along which the travelling support is movable so as to be rotatable with respect thereto while being axially displaceable with respect thereto against the bias of the spring means, one end of the said spindle being connected by a swivel joint to the travelling support and its other end projecting externally from the frame along which the travelling support is movable so as to allow access thereto for the purpose of rotating it to adjust the tension of the spring means.

8. A seat mounting as claimed in claim 7, in which the spring means comprises a pair of tension springs disposed one on each side of the screw-threaded spindle.

9. A seat mounting as claimed in any one of the preceding claims, in which the travelling support comprises a supporting roller rotatably mounted in a carrier, the roller engaging the run-up cam surface.

10. A seat mounting as claimed in any of the preceding claims, in which the travelling support bears indirectly against a guide surface on the frame along which the travelling support is movable by way of a guide roller.

11. A seat mounting as claimed in claim 9, in which the travelling support has a pair of guide rollers mounted one on each side of the supporting roller and having a larger diameter than the supporting roller, the guide rollers resting against a guide surface on the frame along which the travelling support is movable.

12. A seat mounting as claimed in any

of the preceding claims, in which the spring means comprise two tension springs arranged substantially parallel to the direction of movement of the travelling support with the travelling support and the run-up cam surface between them.

13. A seat mounting as claimed in any of the preceding claims, in which the said two corresponding arms are rigidly interconnected to one another by a shaft which serves for their pivotal connection to the frame along which the travelling support is movable and also as a pivotal mounting for the supporting lever.

14. A seat mounting substantially as described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1977.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1491291 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

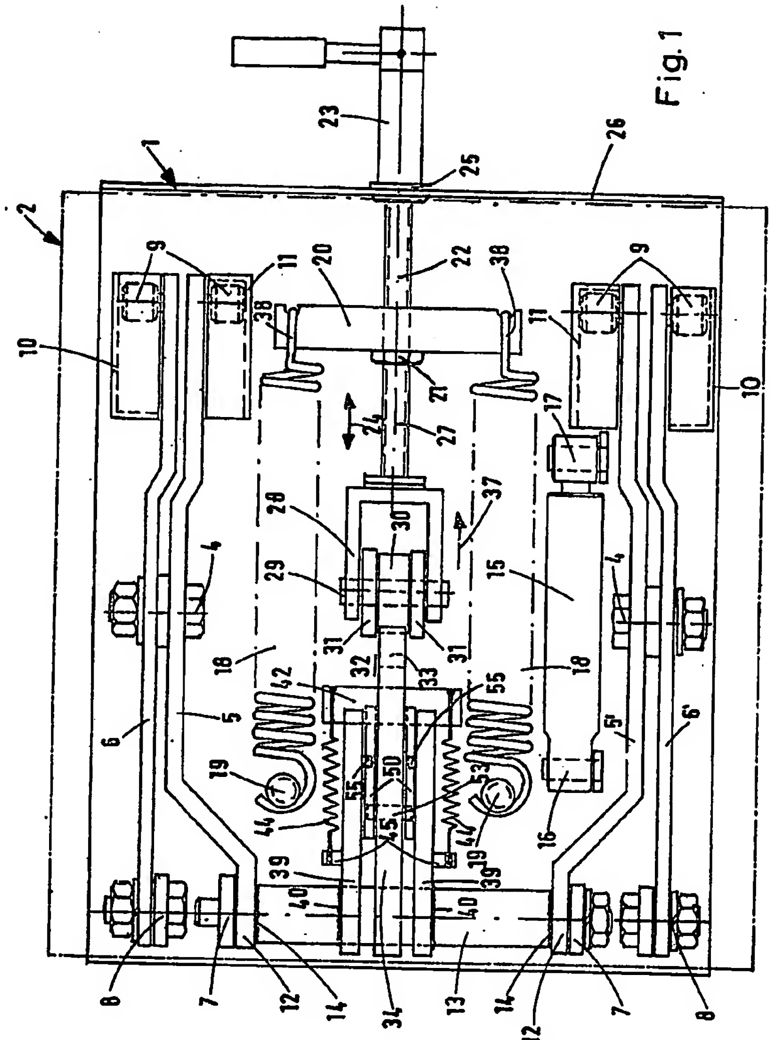

Fig.1

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Sheet 2

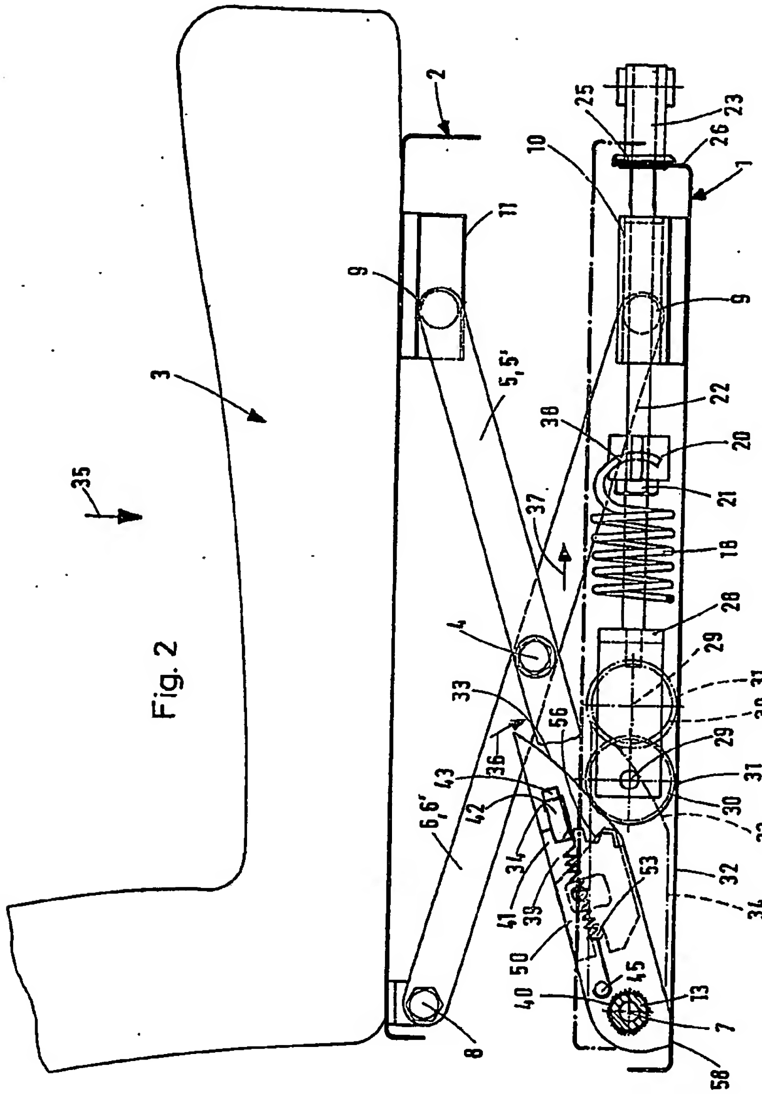

Fig. 2

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Sheet 3

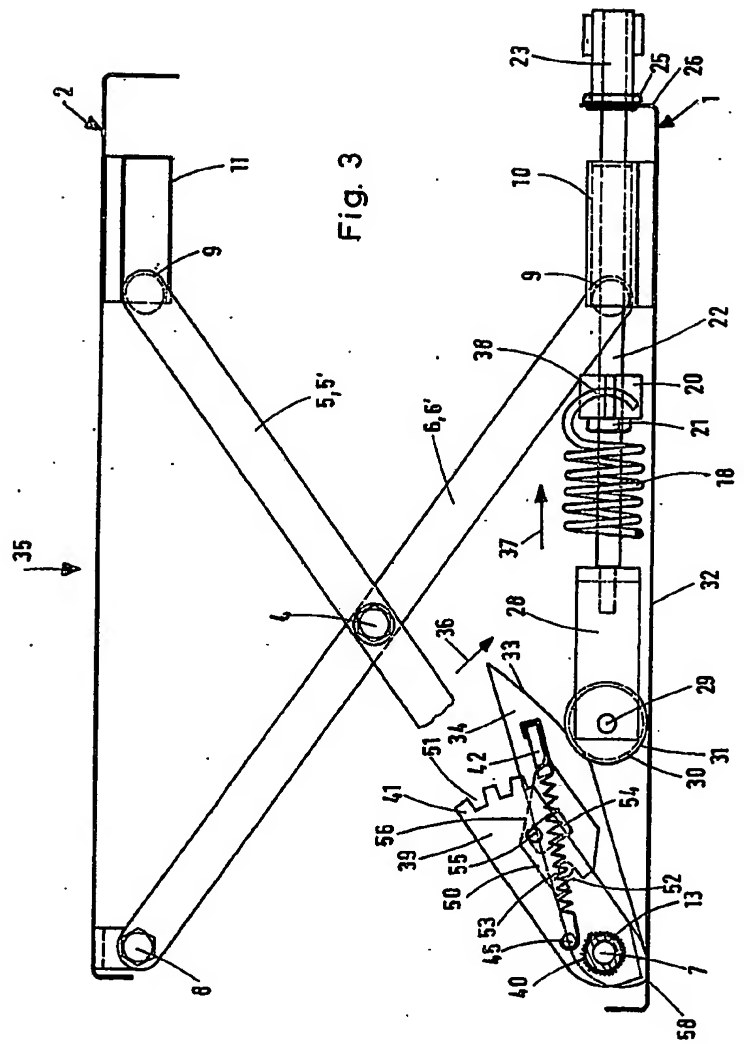

Fig. 3

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Sheet 4

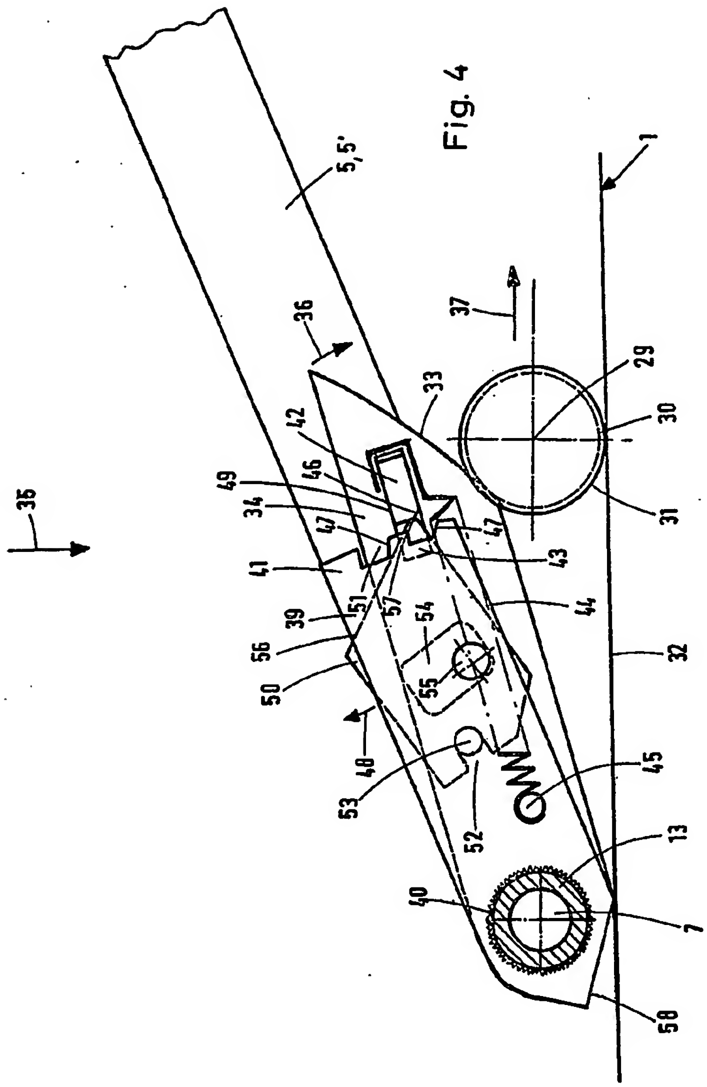

Fig. 4